

Lesson Two: Flooding

Factsheet

Purpose of Lesson

Flooding can have dramatic consequences for the physical environment, changing the course of rivers and submerging huge swathes of land. Flooding can also impact communities. In the UK as a whole, more than £238 billion of assets are at risk from flooding; not just homes, but businesses, hospitals, schools, and essential infrastructure such as roads, railways and sewage treatment plants are all at risk.

In this lesson pupils will learn why and how rivers flood. Using case studies from UK floods in 2007 and 2014 they will also understand the impact flooding can have on people.

Vocabulary

This lesson uses the following geographical terms. Some of these terms will be familiar to pupils from Lesson One. Other terms are new. These should be used and explained to pupils as the lesson is taught.

Familiar Terms

Source	The point at which a river starts
Upper course	The first stage of river, often located on high ground
Middle course	The second stage of a river, where the land is flatter and the river wider
Lower course	The land is flat and the river is at its widest
Channel	The river bed and banks in which water flows
V-shaped valley	The river in the upper course flows through steep gradients
Tributaries	Small streams that join the larger river
Erosion	Material is cut away from river beds and banks by the water
Transportation	When eroded material is taken downstream
Deposition	Material is 'dropped' or deposited when the river no longer has the capacity to carry it
Meander	The natural bend in a river
Mouth	The point where the river ends
Estuary	In the lower course, where the river meets the sea
Precipitation	Precipitation is rain, hail, sleet and snow. It is important that pupils do not think that the only source of fresh water is rain
Surface runoff	When precipitation runs over the surface of the land
Throughflow	When water infiltrates the layer of soil and flows through it, rather than overland

New Terms

Confluence	The point at which a tributary joins the main river, or where main rivers merge
Bankfull	When the river channel is totally full (when discharge is at a maximum)
Discharge	The volume of water in a river (at any one point)
Overbank flow	When the river bursts its banks and the water leaves the main river channel

Flood plain	The area surrounding a river that has been submerged by water as a consequence of overbank flow
Drainage basin	The area of land that drains into one river and its tributaries
Watershed	The boundary of the drainage basin. One drainage basin is defined from others by its watershed
Lag time	The time delay between the heaviest rainfall and the maximum discharge of a river
Recede	The flood water will eventually infiltrate the soil or flow back into the river channel. As the water recedes the river may take a new course

Speed of flow

In the upper course of a river the water flow is often turbulent; this gives the visual impression that the water is fast flowing. In fact, water is faster flowing in the middle and lower course of a river. Here, there is a greater volume of water so proportionally less of it is in contact with the river channel. With proportionally less water in contact with the river bed and the banks, friction is also relatively less and speed relatively greater.

When the discharge of a river is high, not only will the water will be faster flowing, it will also be more erosive.

Lag time

Lag time is the time delay between the heaviest rainfall and the maximum discharge of a river. So, although the rainfall may could have stopped, or lessened considerably, the water level in the river will continue to rise.

It takes time for the water to flow into the main river channel. Not only is the river fed from tributaries in the upper course, surface run off and throughflow will continue to supply the river with water from across the catchment area.

A short lag time will increase the likelihood of flooding; a longer lag time decreases the likelihood of flooding.

Lag times differ depending on the type of vegetation and soils in an area. Shorter lag times are often in areas where the soils are less permeable. Rather than infiltrating the soil, precipitation will runoff the surface of the land and quickly flow into the river. Lag times are also shorter in areas that have been urbanised- building houses and roads on green land will again increase surface run off. Finally, lag times are shorter when rainfall is heavy because water is less likely to infiltrate the soil and will reach the river quickly.

The Environment Agency

5.5 million properties in England and Wales (that is one in six) are at risk from flooding.

The Environment Agency produce detailed guidance on flooding. Go to the Environment Agency's website: <https://www.gov.uk/government/organisations/environment-agency>

Useful information is also available in the Environment Agency publication, *Prepare Your Property For Flooding*. Go to the Environment Agency's website:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/292943/geho1009brdl-e-e.pdf

There are 4 flood warning codes:



Severe flooding. Danger to life



Flooding is expected. Immediate action required.



Flooding is possible. Be prepared.



Flood warnings and flood alerts removed in the last 24 hours.

Flooding Case Studies

Two case studies are highlighted; the UK floods of 2007 and 2014.

Tewkesbury in Gloucestershire 2007: Exceptional rainfall in the summer of 2007 caused extensive flooding in parts of England, especially in South and East Yorkshire, Worcestershire, Gloucestershire and Oxfordshire. The government called the 2007 floods a national catastrophe.

The 2007 floods cost local councils £140 million, and the total cost to the British economy was estimated at £3.2 billion. Gloucestershire was the county worst affected. Across Gloucestershire 1950 people needed temporary accommodation. During the floods, Gloucester Fire and Rescue Service dealt with 1,800 incidents in an 18 hour period, compared to their yearly average of 8,000.

Tewkesbury in Gloucestershire, at one point completely surrounded by flood water, was particularly badly affected. Tewkesbury has a history of flooding. This is why Tewkesbury's historic centre with its abbey and Tudor buildings, were built on the higher land and out of the flood risk zone. Even so, flood water entered Tewkesbury Abbey – this had not happened for 247 years.

During the 2007 flood, in Tewkesbury:

25,000 sandbags were distributed, containing 200 tonnes of sand

133 porta-loos were erected

5 million litres of drinking water was distributed

500 people were given temporary accommodation in rest centres

Nationally, two-thirds of the total cost of the floods was incurred by damage to homes, businesses and vehicles. Alongside this damage however, valuable farm land was flooded (42,000 hectares) and roads and infrastructure badly damaged. Schools were also seriously affected, with the loss of 400,000 pupil days of education.

Flooding 2014: The 2014 flood was the product of continual wet winter weather, causing rivers to burst their banks. Flooding was also caused by coastal storms. Some of the worst affected areas were Somerset, Devon, Dorset and Cornwall in the south west and the Thames Valley in the south

east. Between December and January 2014, The Association of British Insurers paid out claims totalling £426million. The cost to the UK economy is estimated at £1.1billion.

Flooding solutions: To prevent flooding on a similar scale the Government announced in 2014 that it will spend £15.5 million on flood defenses in Somerset over the next six years. Dredging rivers is one, often controversial, solution to flooding. While dredging can help where rivers are too silted up to transport water and debris downstream, dredging tidal rivers is more difficult because material is deposited on every tide.

In response to the 2014 floods, The Association of British Insurers has called for an end to building new homes in flood-risk areas. It says some 20,000 new properties are being built on the floodplain each year, including 4,000 in places where there is significant risk of flooding.

Pupil Activity

Below is a suggested format for the *Flooding Flow Chart* pupil activity. An example of a pupils' work is also available.

- Box 1 Diagram: Rain cloud and precipitation across high land in the upper course.
- Box 2 Diagram: A cross section of land showing water uptake by vegetation, infiltration of the soil and surface runoff. Precipitation is still occurring.
- Box 3 Diagram: A cross section of land showing increased surface runoff.
Annotations: These should suggest that the soil is saturated and cannot absorb any more rainfall, leading to increased surface runoff.
- Box 4 Diagram: A house with sandbags at the front door and/or a person listening to flood warnings on the radio.
Annotations: These should suggest that an advance flood warning has been given and that people should begin to protect their homes by moving possessions upstairs, stocking up on drinking water etc.
- Box 5 Diagram: The middle course of a river with flat land. This river is reaching the bankfull stage.
- Box 6 Diagram: Overbank flow has resulted. The river has burst its banks and the flood plain has flooded.
- Box 7 Diagram: A house is flooded.
Annotations: Flood waters continue to rise.
- Box 8 Diagram: The river begins to recede.
Annotations: The river begins to recede, depositing mud, rocks and other debris onto the flood plain.
- Box 9 Diagram: People begin clearing up their homes after the flood.
Annotations: These could suggest that people try to minimise potential flood damage in the future by laying tiles and rugs on the ground floor, rather than carpets, or by moving electrical sockets higher up walls etc.